

**GENERAL
INSTRUMENT**

**VSM2032
VOICE SYNTHESIS
MODULE
USER'S GUIDE**

Microelectronics Division
General Instrument Corporation
600 West John Street
Hicksville, New York 11802

Printed in U.S.A.

- Complete Speech System
- Stores approximately 30 Seconds of Speech
- 32 Words and Syllables Combine to Form Over One Billion Phrases
- Custom Vocabularies Available
- Simple Digital Interface (TTL)
- 5 Volt Power Supply ($\pm 5\%$)
- Audio Output: 200mw
- Operating Temperature 0° to 70°C
- Dimensions: 3.25" x 5.0"

The VSM2032 utilizes General Instrument's state-of-the-art technology to synthesize speech. The module contains three MOS/LSI devices fabricated with N-Channel Ion Implant Processing resulting in a high performance product with proven reliability and production history. The module interfaces easily to any digital system; eight TTL compatible signals are used to select the phrase to be spoken. Once selected, the VSM2032 requires no support from the user's circuit. It enunciates the phrase and signals when complete.

The VSM2032 is interfaced using a 15-pin card edge connector (Amphenol 225-21521-401 (117) or equivalent). The phrase to be spoken is selected with a 7-bit address (S_0 - S_6). This data is strobed into the module using STROBE. The module will drive the busy line (BUSY) low while it is speaking. During this time, new data will not be accepted.

The module is initialized by applying two low pulses to the $\overline{\text{RESET}}$ pin.

The audio output is available on both the card edge connector and on the module. It is designed to drive an 8 Ω load with 200 mw of power.

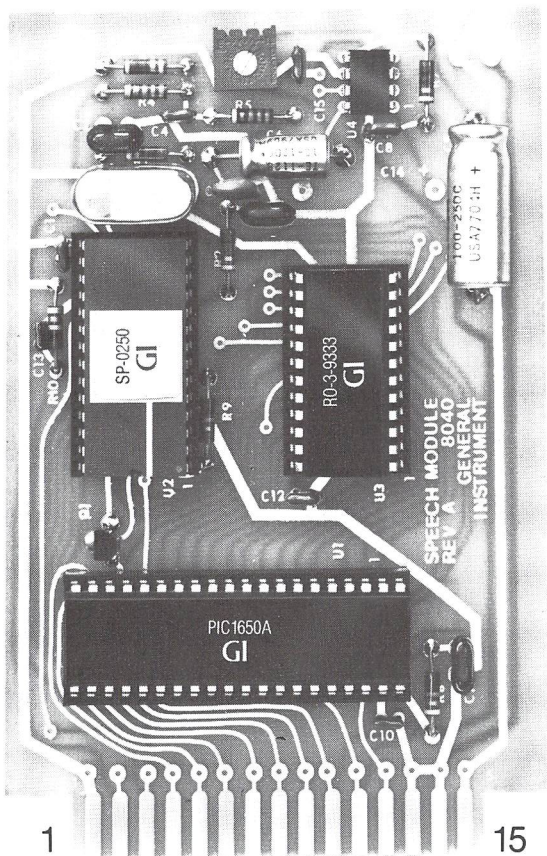
The standard VSM2032 can enunciate the thirty-two words and syllables listed below. Alternate vocabularies are available (contact regional sales office for information).

Numbers less than one billion can be enunciated using this phrase set. For example, 1214.1 would be generated by concatenating the following phrases:

ONE	THOUSAND	TWO	HUNDRED	FOUR	TEEN	POINT	ONE
1 ₈	16 ₈	2 ₈	15 ₈	4 ₈	24 ₈	32 ₈	1 ₈

Addresses 40₈-177₈ are not used with this phrase set. The VSM2032 will lock up if invalid addresses are used.

ADDRESS									ADDRESS								
Octal	S ₆	S ₅	S ₄	S ₃	S ₂	S ₁	S ₀	Phrase	Octal	S ₆	S ₅	S ₄	S ₃	S ₂	S ₁	S ₀	Phrase
0	0	0	0	0	0	0	0	ZERO	20	0	0	1	0	0	0	0	TWEN
1	0	0	0	0	0	0	1	ONE	21	0	0	1	0	0	0	1	THIR
2	0	0	0	0	0	1	0	TWO	22	0	0	1	0	0	1	0	FIF
3	0	0	0	0	0	1	1	THREE	23	0	0	1	0	0	1	1	TY
4	0	0	0	0	1	0	0	FOUR	24	0	0	1	0	1	0	0	TEEN
5	0	0	0	0	1	0	1	FIVE	25	0	0	1	0	1	0	1	PLUS
6	0	0	0	0	1	1	0	SIX	26	0	0	1	0	1	1	0	MINUS
7	0	0	0	0	1	1	1	SEVEN	27	0	0	1	0	1	1	1	TIMES
10	0	0	0	1	0	0	0	EIGHT	30	0	0	1	1	0	0	0	OVER
11	0	0	0	1	0	0	1	NINE	31	0	0	1	1	0	0	1	EQUALS
12	0	0	0	1	0	1	0	TEN	32	0	0	1	1	0	1	0	POINT
13	0	0	0	1	0	1	1	ELEVEN	33	0	0	1	1	0	1	1	ERROR
14	0	0	0	1	1	0	0	TWELVE	34	0	0	1	1	1	0	0	IT IS
15	0	0	0	1	1	0	1	HUNDRED	35	0	0	1	1	1	0	1	AM
16	0	0	0	1	1	1	0	THOUSAND	36	0	0	1	1	1	1	0	PM
17	0	0	0	1	1	1	1	MILLION	37	0	0	1	1	1	1	1	OH



Pin	Signal	Function
1	V_p	5 Volt DC Regulated $\pm 5\%$
2	—	No Connection
3	$\overline{\text{RESET}}$	Initializes Module, Active Low
4	S_0	Phrase Address Bit 0 (LSB)
5	S_1	Phrase Address Bit 1
6	S_2	Phrase Address Bit 2
7	S_3	Phrase Address Bit 3
8	S_4	Phrase Address Bit 4
9	S_5	Phrase Address Bit 5
10	S_6	Phrase Address Bit 6 (MSB)
11	$\overline{\text{BUSY}}$	Indicates Module is Speaking (Active Low)*
12	$\overline{\text{STROBE}}$	Strobes Phrase Address
13	GND	Power Supply Ground
14	SPKRET	Audio Return. Must Be Connected to Logic Ground
15	SPK	Audio Output

*The $\overline{\text{BUSY}}$ signal is used as an input in the test mode. During reset the test mode will be entered if this line is low (logic zero). Make no connections to active pins on the non-component side of board. These signals are for test purposes only.

Maximum Ratings*

Temperature Under Bias	125°C
Storage Temperature	−55° to +150°C
Voltage on any pin with respect to GND	−0.3V to +12.0V
Power Dissipation	1W

* Exceeding these ratings could cause permanent damage to the device. This is a stress rating only and functional operation of this device at these conditions is not implied. Operating ranges are specified in Standard Conditions. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Standard Conditions (unless otherwise stated):

DC CHARACTERISTICS

Operating Temperature $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$

Characteristic	Sym	Min	Typ	Max	Units	Conditions
Supply Voltage	V_p	4.75	—	5.25	V	Audio Off
Supply Current	I_p	—	100	170	mA	
S_0 - S_6 Low Voltage	V_{IL1}	−0.2	—	0.8	V	
S_0 - S_6 High Voltage	V_{IH1}	2.4	—	V_p	V	
RESET & STROBE Low Voltage	V_{IL2}	−0.2	—	0.8	V	
RESET & STROBE High Voltage	V_{IH2}	V_{p-1}	—	V_p	V	$I_{OL} = 1.6\text{mA}$ (NOTE 1) $I_{OH} = -100\mu\text{A}$
BUS $\overline{\text{Y}}$ Output Low Voltage	V_{OL}	—	—	0.8	V	
BUS $\overline{\text{Y}}$ Output High Voltage	V_{OH}	2.4	—	V_p	V	
Input Low Current	I_{IL}	−0.2	−0.6	−1.6	mA	
Input High Current	I_{IH}	−0.1	−0.4	—	mA	
Audio Output	A_p	—	—	200	mW	$V_{IH} = 2.4\text{V}$ $8\Omega\text{LOAD}$

NOTE:

1. Positive current indicates current into module. Negative current indicates current out of module.

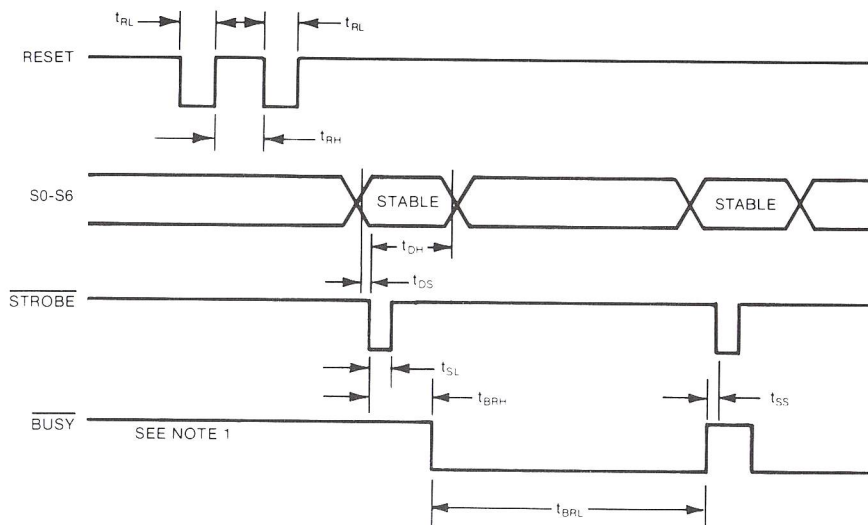
Standard Conditions (unless otherwise stated):

AC CHARACTERISTICS

Operating Temperature $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$

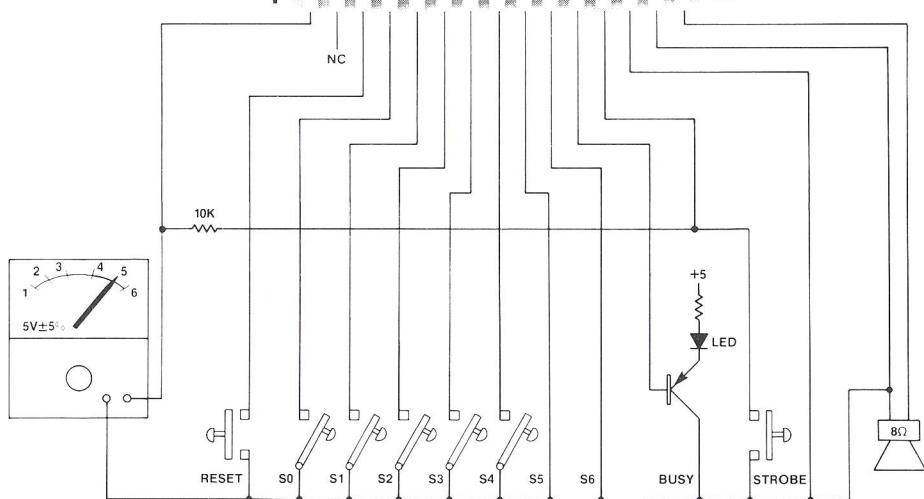
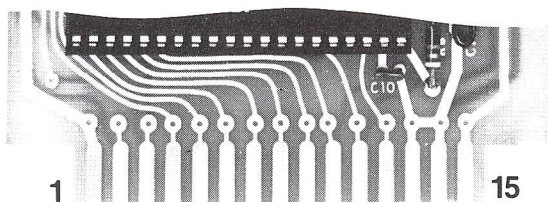
Characteristic	Sym	Min	Typ	Max	Units	Conditions
RESET Low Time	t_{RL}	5	—	—	μs	Two resets are required.
RESET High Time	t_{RH}	200	—	500	μs	
Data Hold Time	t_{DH}	50	—	—	μs	
Data Setup Time	t_{DS}	0	—	—	ns	
BUS $\overline{\text{Y}}$ Response Time High	t_{BRH}	—	—	40	μs	
STROBE Setup Time	t_{SS}	0	—	—	ns	Determined by Length of Phrase
STROBE Low Time	t_{SL}	5	—	—	μs	
BUS $\overline{\text{Y}}$ Response Time Low	t_{BRL}	—	—	—	—	

TIMING DIAGRAM



NOTE:

1. The BUSY line (used as an input for testing) must be high (logic One) during RESET.

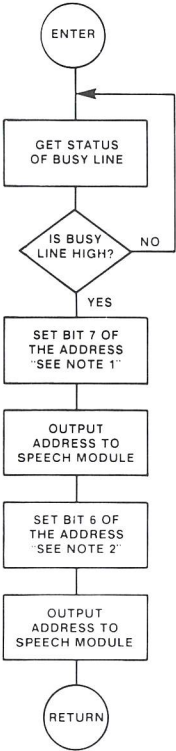


The VSM2032 can be easily interfaced to a parallel port on any computer or microprocessor system. The TRS-80™ Model 1 personal computer is used as an example of this operation.

VSM2032 CONN.	TRS80 LINE PRINTER CONN.	ADDITIONAL CONNECTIONS
1 V_p	—	+5V $\pm 5\%$
2 <u>RESET</u>	—	—
3 S0	17 DATA 8	—
4 S1	3 DATA 1	—
5 S2	5 DATA 2	—
6 S3	7 DATA 3	—
7 S4	9 DATA 4	—
8 S5	11 DATA 5	—
9 S6	13 DATA 6	—
10 <u>BUSY</u>	—	GND
11 <u>STROBE</u>	21 BUSY	—
12 GND	15 DATA 7	—
13 SPKRET	2 GND	GND
14 SPR	—	GND
15	—	8Ω SPEAKER

This routine interfaces the TRS-80 Model 1 to the VSM2032 speech module through the parallel printer port.

The routine waits for the busy line to go high (speech module not talking) and then outputs the address of a phrase to the speech module.



- Note 1: Calling program must reset speech module by outputting two successive low to high transitions on pin D₈ of parallel port.
- Note 2: A high to low transition on D₇ strobes the address into the speech module.

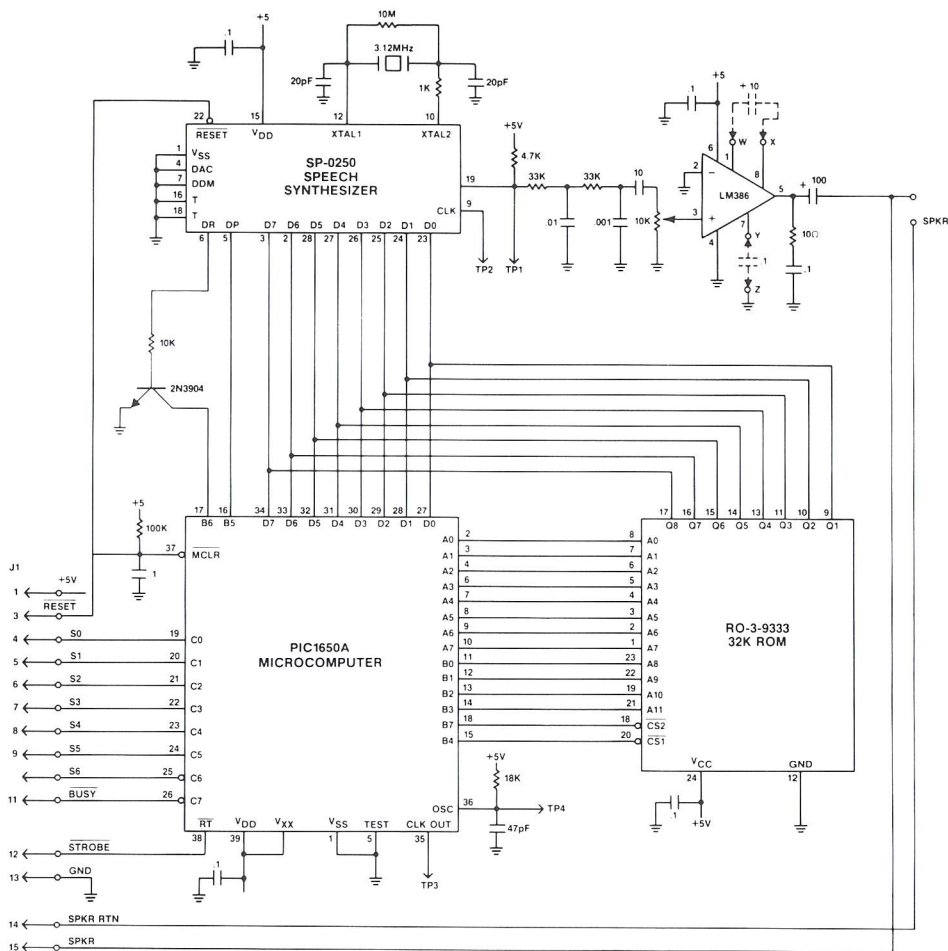
These four statements will reset the speech module.

```
510 POKE 14312,64
520 POKE 14312,192
530 POKE 14312,64
540 POKE 14312,192

795 REM OUTPUT ADDRESSES TO SPEECH MODULE
800 XB = PEEK (14312)
810 IF XB <128 THEN GOTO 800
820 XA(XI) = XA(XI) +128
830 XC% = XA(XI)
840 POKE 14312,XC%
850 XA(XI) = XA(XI) +64
860 XC% = XA(XI)
870 POKE 14312,XC%
880 RETURN
```

- XA: Array—stores the addresses
- XI: Index to XA array
- XB: Busy yes/no
- XC%: Stores one character from XA array

W SPEECH MODULE



NOTES:

1. J1 mates to Amphenol connector 225-21521-401(117).
2. Capacitors shown as dotted lines on LM386 can be added to increase gain.
3. All capacitor values are μF except where noted.
4. SPKR RTN must be tied to System Logic Ground.

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